cinomatous tissue. A fourth diverticulum was found on the side opposite the preceding two, and completely outside of the carcinomatous area. This is shown somewhat magnified in Fig. 3. This diverticulum is exactly like certain ones previously described by me.[8] It is a false diverticulum, that is, all the walls of the viscus are not carried outward, but the muscularis is penetrated by the coats lying within it. A large amount of inflammatory connective tissue has developed around the base of the diverticulum. The distal end of the pocket contained a small, dark, fecal concretion when it was opened. This specimen is particularly interesting in that it shows various stages in the destruction of previously formed diverticula by a carcinoma developing thereon. The abundant connective tissue formed in the wall of the sigmoid about the outer extremities of the diverticula was, no doubt, the result of a peridiverticulitis, which long preceded the carcinoma. It is, of course, impossible to say whether the chronic irritative process was the only etiological factor in the development of the malignant growth. The conditions, however, would seem to be somewhat analogous to those in the stomach when a chronic ulcer has become the base of a developing carcinoma, a process which pathologists and surgeons are now coming to recognize as the usual association in gastric carcinoma. It would seem important that we go over most carefully all carcinomas of the colon for remains of diverticula. There is no doubt that these anomalies are much more numerous than we have hitherto supposed, and their presence may account in some measure for the relative frequency of carcinoma of the colon as compared with that of the small intestine. Difficulty in determining their presence is due to the fact that most cases of carcinoma coming to operation or autopsy are so far advanced that evidence of preëxisting diverticula may have been destroyed in the necrotic centre of the tumor. Certain specimens of colon carcinoma which I have examined recently strongly suggested the presence of diverticula, but it was impossible to determine their exact etiological relationship owing to the mentioned fact.

CERVICAL RIB AND ITS RELATION TO THE NEUROPATHIES.

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The congenital anomaly, development of a cervical rib in human beings, may reasonably be interpreted as an evidence of atavism, since in embryos of lower vertebrates every vertebra has a rib attached to it. In reptiles, these embryonic elements proceed to the formation of true ribs; in man, the first seven cervical ribs remain rudimentary. The occasional abnormal formation of a cervical rib originally possessed purely an anatomical and morphological interest, and passed as a curious anomaly, sometimes discovered in autopsies as accidental findings. Clinical significance was given to the condition when hard tumors were demonstrated in the supraclavicular fossa of living subjects, giving rise to symptoms of pressure upon vessels and nerve trunks, with, in many cases, prompt subsidence of these phenomena after extirpation of the tumors. These osseous formations were found to be cervical ribs. More recent research in this direction includes cervical rib among the so-called stigmas of degeneration, or rather anomalies of development, and assigns it a certain place as a combined factor in various neuropathic disturbances. The occurrence of this anomaly was known to Galen, but the knowledge of the present is essentially based upon the monograph of Wenzel Gruber,[1] published in 1869, which contains a compilation of the recorded cases, supplemented by personal observations. The oldest description of cervical rib is probably given by Hunauld,[2] in 1742.

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[8] Loc. cit.

In the great majority of cases the bearer of a cervical rib is not conscious of its presence; but an originally harmless malformation of this kind may act as a compressing tumor, as the result of traumatic periosteitis.[3] Aside from traumatism, the late and slow development of the disturbances, which rarely manifest themselves before adult age, has been referred to loss of "padding," through constitutional diseases, such as anemia and rheumatism (bringing the bony protuberances in direct contact with the nerves and subclavian artery, followed by disturbances in the corresponding area of innervation and blood supply), and to the retraction of the pulmonary apices in healed tuberculous lesions. In each of the four cases observed by Nickol[4] in Senator's clinic, a tuberculous affection of the pulmonary apex was found on the same side as the cervical rib, and in the bilateral cases of cervical rib catarrhal affection was revealed over both apices.

The symptoms caused by a cervical rib may be: (1) Of purely nervous origin; (2) neuromuscular; (3) of circulatory character; (4) of a local nature. The first two groups of symptoms, which are closely related to each other, are those to be especially discussed in this paper and illustrated by my own observation. As is usual in bilateral cases, the symptoms were originally confined to the side of the larger rib.

The patient is aged twenty-eight years. Her history, both family and personal, is entirely negative from a neuropathological point of view. Symptoms referable to the cervical rib date apparently from the patient's eighth year. She then began to suffer pains in the left shoulder radiating down the arm; the entire left upper extremity would become paroxysmally numb. She noticed also gradual development of an indefinite sense of discomfort of the left shoulder; likewise, a protrusion of the left shoulder blade, which, when pressed upon, gave rise to varying degrees of pain and numbness through the left arm. These symptoms persisted. In the course of a few years there was added a certain inability properly to use the left index finger, noticed particularly in piano playing, and gradually a certain lack of dexterity of the left hand. When about eighteen years old, the patient noticed that certain movements of the arm, for example, arranging her clothing, necessitating placing the arm behind her, caused flexor spasm of the muscles of the forearm and hand. At this time there was no weakness and no wasting of the muscles. In October, 1904, the patient noticed weakness in grasp and in finer movements of the left hand. Steadily progressive atrophy of the small hand muscles developed; both thenar and hypothenar surfaces were involved. Soon after, a coldness of the left upper extremity, particularly from the elbow to the finger tips, was at times subjectively felt and objectively demonstrated. It was noticed that when the hand became temporarily cold, muscular weakness became more pronounced for the time being. Paroxysmal attacks of objective pallor and coldness occurred independently of the position of the extremities.

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[1] Ueber die Halsrippen des Menschen, St. Petersburg, 1869, Mém. de l'acad. imp. d. sc., vii Series, 13, No. 2.

[2] Mém. math. et phys. d. l'acad. r. d. sc., lvii, 1742.

[3] Wien. klin. Woch., 1896, No. 6.

[4] Inaugural Dissertation, Leipsic, 1906.

My examination in 1904 revealed areas of hypesthesia and hyperalgesia irregularly distributed over the left forearm and hand. These areas varied, and finally disappeared, leaving, as the only sensory disturbance, an area of hypesthesia for all forms of sensation in that part of the forearm and hand corresponding to the inner cord of the brachial plexus, particularly the ulnar distribution (Fig. 1). In 1904 the left hand presented in appearance the typical *main à griffe*. The following comparative measurements (1904 to 1908) show that the atrophy itself had remained about the same for the past four years (previous to operation):

	Inches.	
	1904	1908
7 inches inferior to the acromial end of the clavicle, circumference of the upper forearm:		
left	9⅝	9½
right	10½	10½
5 inches below the bend of the elbow:		
left	6½	7¼
right	8½	8¾
2 inches above the wrist joint:		
left	5½	5½
right	5¾	6
Circumference of the palm, fingers extended:		
left	7½	6¾
right	8	8

I noted some atrophy of the left pectoral muscles in 1904. The same condition existed in 1908 (Figs. 2, 3, and 4).

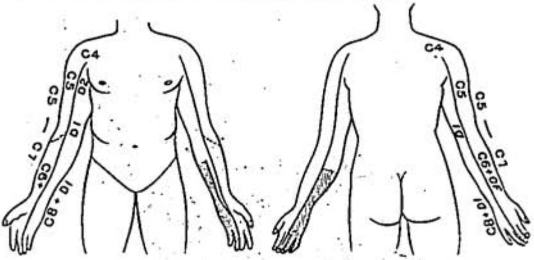

FIG. 1.—Diagram showing the peripheral distribution of the roots of the brachial plexus. *C1* to *C8*, area of nerve supply of the first to the eighth cervical roots; *D1*, area of supply of the first dorsal root. The shaded area on the left forearm shows the area of diminished sensation—eighth cervical and first dorsal roots—in author's case of cervical rib. This is the area usually affected in cases of cervical rib.

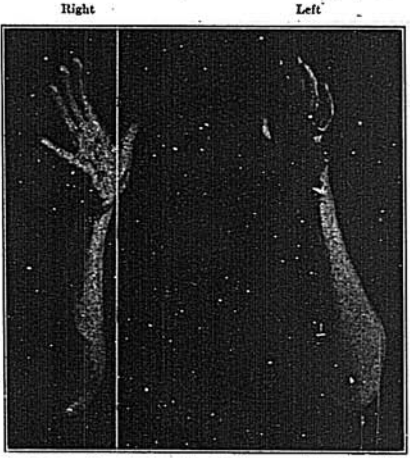

FIG. 2.—Showing muscular atrophy of the left forearm and hand. (Author's case.)

Physical examination revealed an osseous tumor on the left side two inches outside of the sternal insertion of the sternocleidomastoid muscle and extending vertically two inches from the upper clavicular

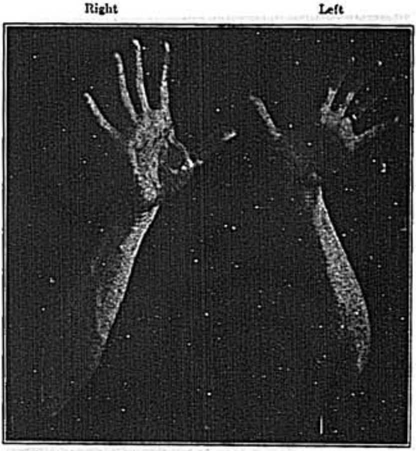

Fig. 3.—Showing atrophy of the left palmar muscles. (Author's case.)

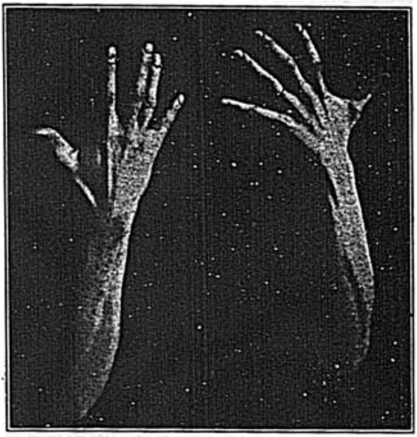

Fig. 4.—Showing particular atrophy of the interossei of the left hand. (Author's case.)

border. On the right side a far smaller eminence was found in about the same position (Figs. 5 and 6). The x-rays disclosed scoliosis

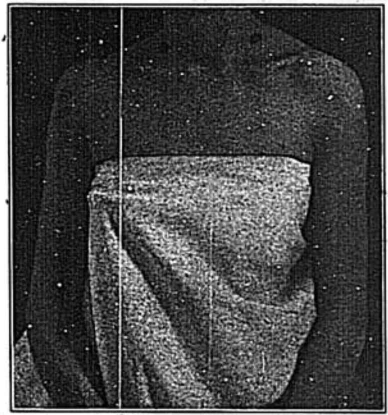

FIG. 5.—Showing the positions above the clavicles at which the osseous growths (false ribs) were seen and felt. (Author's case.)

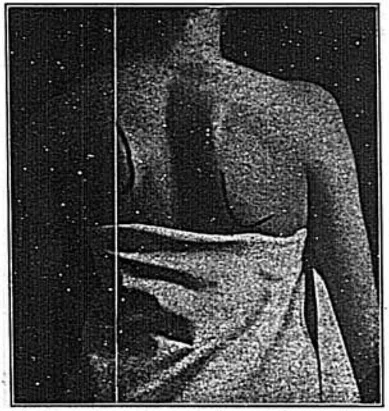

FIG. 6.—Showing the relative positions of the inner and lower borders of the scapulæ The high scoliosis is also evident. (Author's case.)

extending from the sixth cervical to the fifth dorsal vertebra, with convexity to the left side; compensatory scoliosis below. Bilateral cervical ribs were seen attached to the bodies of the seventh cervical vertebræ, articulating at their distal ends with a facet from the upper border of the first dorsal ribs. On the left side the supernumerary rib measured about one and three-quarters inches; the right one, about two inches in length. At the angle of the cervical rib there was an upward protuberance far more marked on the left side. The scoliosis, as well as the angular displacement of the rib, give it greater prominence and greater interference with the plexus on that side. The third normal rib on the left side was markedly smaller in diameter than its fellows. The radiogram was made by Dr. L. G. Cole; by means of it I was able in 1904 to confirm my diagnosis of cervical ribs (Fig. 7).

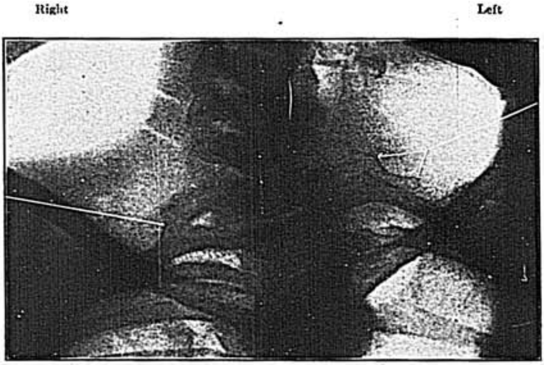

Fig. 7.—Radiogram of the author's case made before removal of the false ribs. The supernumerary ribs are indicated by arrow heads. Note the greater prominence of the left cervical rib. Scoliosis is evident. (The radiogram was made by Dr. L. G. Cole, New York.)

In my examination, in 1904, the radial pulse on both sides showed no change in volume. I failed to observe the position of the subclavian artery at that time. During the last year I have observed a diminution in the volume of the radial pulse on the left side; the subclavian artery pushed upward by the false rib, crosses the rib anteriorly; slight compression of the vessel against the rib obliterates the pulse. A distinct bruit but no thrill is heard over the subclavian on the right side only. As will be observed, the vascular symptoms are slight. These observations were made also just prior to operation for removal of the ribs.

It was clinically possible to demonstrate upon careful palpation the exact location of the three roots formed by the fifth, sixth, seventh, and eighth cervical and first dorsal nerves in their relation to the supernumerary rib on the left side. The fifth and sixth were felt lying superiorly about at the summit of the rib and somewhat anteriorly, freely movable. The seventh and eighth were more inferiorly, although pushed upward by the rib. The eighth cervical and first dorsal were deep between the supernumerary and the first normal rib, and could hardly be reached. Pressure with the finger tip upon each of these bands of fibers produced a numbness in the area of the arm supplied by each. The position of the eighth cervical and first dorsal pressed upon as the fibers were, by the cervical rib, explained doubtless the hypesthesia in the ulnar distribution, as well as the muscle atrophy of that nerve supply.

The weight of the patient since 1904 has remained unchanged. In 1906 she gave birth to a child. During the course of her pregnancy, her subjective sensory symptoms, she tells me, were more troublesome. The confinement was normal; the offspring normal, except showing apparent secondary lesions of specific infection. Shortly before the delivery, specific manifestations appeared on the mucous membranes, buccal and vaginal, of the mother. The history of the case points to infection after a second marriage in 1905. Periodic outbreaks of specific symptoms affecting the mucous membranes have since appeared, yielding rapidly to treatment. The patient began, about six months before operation to observe a weakness in the right index finger and a certain want of dexterity in executing the finer movements of the right hand. A slight numbness likewise was complained of occasionally in the right thumb, thus indicating involvement of the right upper extremity. Within the next few months numbness in the right lower extremity, and pains in the calf muscles, were complained of, and I have been able to detect at times a slight but manifest weakness in the flexors of the toes of the right side; no sensory and no electrical changes.

In May, 1908, my patient submitted to the operation for removal of the cervical ribs. The operation was performed by Dr. Alfred S. Taylor, of New York. We found the relations of the rib on the left side and the plexus roots as had been determined by palpation (Fig. 8). The relation of the cervical ribs to the first normal rib had been shown by the x-rays. The subclavian artery crossed the first rib, anterior and below the end of the cervical rib, the roots of the plexus lying over the supernumerary rib. The eighth cervical and first dorsal roots crossed the distal end and were undergoing the most tension and pressure. This coincided with the clinical symptoms. The relation of the structures was about the same on both sides. The upper roots were so situated as to be but little compressed. The roots appeared normal to the naked eye. A few fibers of the scalenus muscle were inserted into the upper surface of the extra rib on both sides. The subclavian artery crossed the first rib anterior to and below the end of the cervical rib; the roots of the brachial plexus were lying over the cervical rib. The cervical ribs on both sides articulated with the bony process attached to the upper surface of the first rib. There was a strong fibrous capsule between the two, but very little motion. Fig. 9 shows the size and shape of one of the false ribs after removal. Immediately after the operation there was paralysis of almost the entire brachial plexus distribution, both sensory and motor, affecting particularly the left side. In the course of a week, motion and sensation began to return, and there has been slow but constant improvement. At present, over one year after the operation, there is still very considerable atrophy and still very slight sensory changes along the lower forearm on

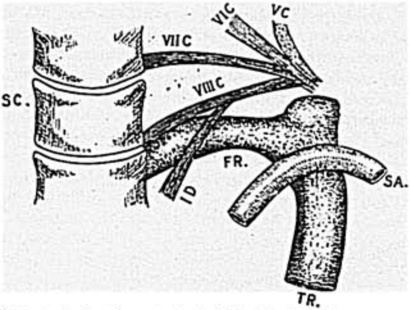

FIG. 8.—Diagram showing the anatomical relationship of the false or cervical rib (*FR*, to the subclavian artery (*SA*); first or normal rib (*TR*); spinal column (*SC*); fifth, sixth), seventh, eighth cervical and first dorsal nerve roots (*VC*, *VIC*, *VIIC*, *VIIIC*, *ID*).

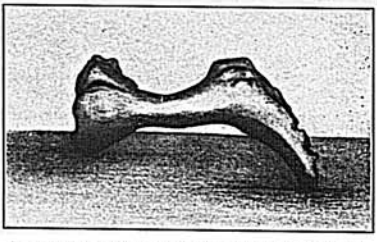

FIG. 9.—One of the false ribs after removal (natural size).

the inner side. Fig. 10 shows a radiogram taken after the removal of the cervical ribs; it should be compared with Fig. 7. The details of the technique of the operation will be published later by Dr. Taylor.

Cervical rib as a factor in the estimation of obscure nervous symptoms is entitled to greater attention than it has received. In those cases in which these ribs are discovered, the patient complaining of nervous disturbances, those diseases of the nervous system should be borne in mind which are known to develop upon the basis of an abnormal predisposition, a neuropathic diathesis. At the same time, the hereditary and family relations must be taken more seriously into consideration. Cervical rib was observed in two sisters, by Israel.[5] In all the cases of cervical rib which are brought to the physician's attention, the entire nervous system should be examined. The condition is often combined with other nervous diseases—especially syringomyelia—which are not due to the cervical rib, but arise on the common soil of the same neuropathic diathesis (Oppenheim[6]). Hysteria and hypochondria have been observed in patients having a cervical rib, and Oppenheim mentions two cases presenting symptoms of gliosis, in whom a direct compression of the recurrent nerve had been assumed on the basis of the

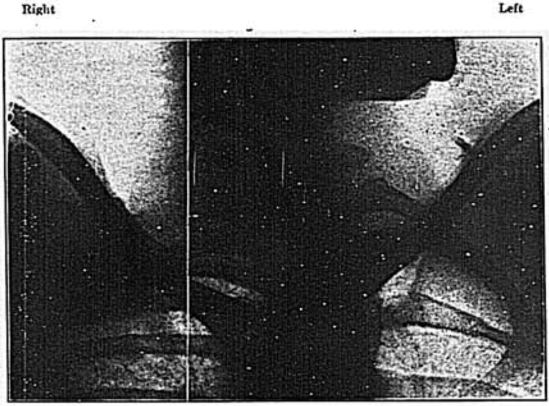

FIG. 10.—Radiogram of the author's case, made after surgical removal of the false ribs. (The radiogram was made by Dr. L. G. Cole, New York.)

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[5] Berl. klin. Woch., 1901, 1189.

[6] Lehrb. d. Nervenkrankht., 1905, vol. i; Berl. klin. Woch., 1901, No. 47.

recurrent paralysis. Sensory disturbances which are not limited to the region supplied by the brachial plexus point to the presence of other nervous affections. The coincidence of nervous diseases, arising upon the basis of congenital anomalies of development, assumed by Oppenheim, is of especial interest in patients having cervical rib.

ANATOMY AND EMBRYOLOGY. Cervical ribs correspond to the processus costarius of mammals, and originate through the failure of fusion between the processus costarius and lateralis, with continued growth of the former (Aron[7]). Their location is at the anterior aspect of the transverse process of the sixth and seventh cervical vertebræ, which possesses an independent bony centre. (The transverse processes of the cervical vertebræ consist of an anterior and a posterior segment, between which lies the foramen transversalium. The anterior shank of this transverse process corresponds to a costal rudiment, and has accordingly been designated as processus costarius.) If the processus costarius of the seventh cervical vertebra is abnormally well developed, the result is a cervical rib. As a rule, in these cases, a supernumerary rib of unequal development is found on either side, one side presenting a short stump, the other a more or less well developed rib.

At a very early period of fœtal life the "Anlage" for the ribs is found along the entire vertebral column, from the highest to the lowest segment. The development of true ribs is confined to the thoracic region, whereas the "Anlage" in the cervical and lumbar vertebræ undergoes retrogression into short rudiments, which may still be recognized by the peculiar configuration of the transverse processes. In certain rare cases, accessory ribs have been observed in the lumbar region, but this anomaly is without clinical importance. There is no case on record in which a supernumerary rib had developed in both lumbar and cervical regions in the same individual. Genuine cervical ribs articulate almost invariably with the seventh cervical vertebra, and are composed, as a rule, of a head, neck, and tubercle. The course of ossification presumably resembles that of normal ribs, in which the centres make their appearance in the head and tubercle about the age of fifteen years, fusion with the rest of the rib taking place about eight years later. In the majority of the cases the anterior extremity of the cervical rib is curved off downward at a right angle, the bone becoming continuous with the first rib.

Cervical ribs discovered accidentally at autopsies, or in living individuals, are by no means rare; Pilling,[8] in 1894, was enabled to compile 139 authentic cases. Women seem to be somewhat more subject to them than men; Ranzi[9] found 17 cases in women against

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[7] Berl. klin. Woch., 1892, p. 826

[8] Inaugural Dissertation, Rostock, 1894.

[9] Wien. klin. Woch., 1903, No. 10..

12 in men, and Bernhardt's[10] observations were to the same effect. Among the 42 patients operated upon, collected by Keen,[11] there were 31 females and only 11 males. The fact that cervical ribs are, as a rule, bilateral (67 per cent.) has been established by the *x*-rays; one is always better developed than the other, and usually at a higher level, as is evident in my own case. A complete cervical rib, extending from the spinal column to the sternum, is very rare. There are two cases on record in which two cervical ribs were found on the left side, and likewise but two cases in which symptoms were well developed on both sides. My case makes the third. The anomaly was most frequently discovered in patients past twenty years of age, and some patients had actually passed the half-century mark (Rutkowski,[12] Keen's case). In rare cases the symptoms date from childhood (my case).

Gruber's classification has been so frequently repeated that the more recent grouping suggested by Blanchard[13] is given here, after Kammerer:[14] First group, in which there is a complete supernumerary rib attached to the sternum; only one autopsy recorded. Second group, in which the cartilage of the supernumerary rib is united with the cartilaginous end of the first dorsal rib; also a rare occurrence, but more common than the first variety. Third group, in which the two extremities of the rib are developed as bony structures, but the intermediate portion is represented by a band of fibrous tissue. Fourth group, in which the two extremities of the rib are developed, but not united by a fibrous band. The anterior extremity may be of bone or cartilage, and it may be attached to the sternum or to the cartilage of the first rib. The posterior extremity is practically always attached to the seventh cervical vertebra, and its anterior end is either free or united to the first rib by an articulation or by bony tissue. Fifth group, in which the supernumerary rib is represented only by a segment attached to the vertebra and there is no indication of an anterior extremity.

The clinical symptoms of cervical rib are more readily understood upon the basis of a similar classification, being without exception referable to pressure upon important adjacent structures, namely, the roots of the brachial plexus and the subclavian artery. As a rule, both the nervous and vascular phenomena develop gradually, up to several years, but the onset may be abrupt, probably determined by traumatism.

NERVOUS DISTURBANCES. Cervical rib must be admitted as an etiological factor in local neuralgias of the arm and hand. In a general way, the symptoms caused by interference with the brachial plexus, which originate not so much as the result of pressure, but rather of stretching and pulling of the plexus above the supernumerary bone, are not in proportion to the size of the rib. Small cervical ribs may cause considerable trouble, and large ribs may be relatively harmless, since the nerves pass across the first portion of the cervical rib, and the further development of the bone is accordingly a matter of indifference for the plexus (Seiffer[15]). The disturbances caused by compression of the brachial plexus are rather sensory than motor. The first of all nervous symptoms is pain, radiating down the arm, sometimes as far as the hand (my case). After a period of paresthesia, hyperesthesia, or hyperalgesia, there follows a diminution of sensation. In regard to the sensory loss in cases of cervical rib, analgesia is said, as a rule, to be more pronounced than tactile anesthesia (see Fig. 1), suggestive of a root lesion, as first pointed out by Sherrington. Ataxia may be present, but complete paralysis has not been reported.

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[10] Berl. klin. Woch., 1901, p. 1189.

[11] The Symptomatology, Diagnosis, and Surgical Treatment of Cervical Ribs, AMER. JOUR. MED. SCI., 1907, cxxxiii.

[12] Zur Diagnostik der Halsrippen, Ztschr. f. klin. Med., 1906, 60.

[13] La revue scientifique, 1885, i, 724.

[14] Cervical Ribs, Annals of Surgery 1901, 34.

The typical sensory change of cervical rib consists in the loss in the distribution of the eighth cervical and first dorsal root, more particularly the latter, which may be exclusively involved. It is this nerve which supplies the fibers to the nerve of Wrisberg, or lesser internal cutaneous nerve, the smallest of the branches of the brachial plexus. It will be remembered that the nerve of Wrisberg is distributed to the integument of the inner side of the arm, the back part of the lower third as far as the elbow; and that it connects with the posterior branch of the internal cutaneous nerve. The ulnar nerve distribution is likewise involved.

Owing to involvement of the ulnar nerve fibers, the inner side of the forearm is likewise usually hypesthetic. The exclusive involvement of this area alone should direct attention to the possibility of cervical rib. The involvement of the fibers from the eighth cervical and first dorsal branches, resulting in hypesthesia along the ulnar surface of the forearm, is well explained by Howell. The first dorsal route, as it becomes part of the brachial plexus, passes almost directly upward on the neck of the first thoracic rib; it thus easily comes in contact with the false supernumerary rib, curving downward and forward. As Howell has observed, the longer ribs cause less pressure than the shorter ones. The first dorsal route lies on the upper surface of the neck and body of the first rib, and in lateral movements of the neck and head may be compressed against the seventh cervical rib, though when the head is held in a straight position the nerve may not be in contact with the cervical rib.

NEUROMUSCULAR DISTURBANCES. The symptomatology of cervical rib may closely resemble that of a lesion of the first dorsal branch of the brachial plexus. A connection between wasting of the intrinsic muscles of the hand and the presence of cervical ribs was first pointed out by Thorburn[16] in 1904. Two cases of atrophy of the intrinsic muscles of the hands, reported by him, are shown by the x-rays to be associated with the presence of cervical ribs. Lewis Jonès,[17] upon the basis of x-ray examinations of all his accessible former patients with this type of muscular atrophy, agrees with the above assumption of cervical rib playing an important part in the production of atrophy of the muscles of the hand. "Well-marked cervical ribs were found to exist in 10 out of 14 cases examined." Moreover, an extra rib was present on both sides in eight patients who presented symptoms on both sides; whereas there was a cervical rib on the affected side alone in two patients with wasting of one hand. As pointed out by Keen, the muscles involved point to the lower cords of the brachial plexus, and not to the upper. According to him, the wasting is especially marked in the thenar and hypothenar muscles, but the interossei and forearm muscles may be affected, and there may be loss of power in the muscles of the shoulder and the chest. As to the cause of the muscular atrophy, it seems to be more rational to seek this in the compression of the nerves rather than in the diminished blood supply. This view seems to be borne out by the results of surgical interference, and is substantiated by my own observation.

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[15] Monats. f. Psych. u. Neurol., vol. xvi, Heft. 4.

VASCULAR DISTURBANCES. Circulatory symptoms may be entirely or nearly absent, even in well-marked cases of cervical rib, as in the cases reported by Fischer[18] and myself—for the reason that the subclavian artery passes in the normal way over the first rib. There is generally a well-marked pulsation in the neck, but this is not invariably the case. Aneurysms of the subclavian artery, in the portion lying between the rib and the clavicle in the supraclavicular space, and thrombosis in the arteries of the upper extremity have been observed as the result of pressure from a cervical rib. Grave nutritive changes are of uncommon occurrence, but endarteritis obliterans and gangrene of the finger tips have been reported as a result of arrest of circulation. In milder cases the temperature of the arm on the side of the rib is lower, and the hand has a tendency to become pale and bloodless on trifling exertion. The subclavian vein does not suffer as does the artery, since its anatomical position gives it abundant space.

LOCAL EVIDENCES. A pathognomonic local sign of cervical rib does not exist. A more or less vertical osseous protuberance above the middle of the clavicle, in the lateral cervical region, especially when combined with superficial pulsation of the subclavian artery, and pressure symptoms in the brachial plexus, may be regarded as a presumptive, but hardly as a positive sign. A guarded diagnosis of cervical rib under these circumstances should be confirmed by means of the *x*-ray plate.

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[16] The Seventh Cervical Rib and its Effects upon the Brachial Plexus, Medico-Chir. Trans., 1905, 88, p. 109.

[17] Cervical Ribs and Atrophy of the Hand, Quart. Jour. Med., 1908, i, 2.

[18] Deut. Ztschr. f. Chir., 1891-92, xxxiii.

Scoliosis is almost invariably associated with cervical rib. Their relationship as to cause and effect is in dispute. I believe that the scoliosis is not a simple mechanical effect of the cervical rib. A careful study of the anatomical features of the cases reported in the literature does not support the view that the scoliosis results from the mechanical displacement. Among 400 cases of scoliosis, Helbing demonstrated by *x*-rays that 2 per cent. were accompanied by cervical rib. This author describes two characteristic features of this form of scoliosis, high position of a very rigid scoliosis, and turning or mal-position of the head with asymmetry of the face skeleton and resulting difference in the contour of the neck and shoulder on the two sides.

Levi[19] in his report of a case of bilateral cervical rib, in a girl having multiple sclerosis, warns us against a premature diagnosis of cervical rib on the basis of the *x*-ray picture. The transverse process of the seventh cervical vertebra is so prominent in *x*-ray exhibits that in two other cases the diagnosis of cervical rib of the first degree was rendered by experienced *x*-ray specialists. One of these was a case of syringomyelia, the other of plexus neuritis, and the diagnosis of cervical rib was proved to be erroneous by comparison with a series of radiograms of normal cases. In this connection it is of interest to note Jones' comment on a camera photograph of a bony specimen in the Museum of the Royal College of Surgeons (see Hinds Howell's paper[20]), which has cervical ribs on both sides, but the one on the left side is short and irregular in shape, and lies in close relationship to the first true rib. "Such a rib photographed by *x*-rays in the living subject would probably give an impression on the plate of an overgrown transverse process of irregular outline, an appearance which is sometimes seen in *x*-ray photographs of the cervical region."

ASSOCIATION WITH NERVOUS DISEASES (DEGENERATIVE TYPE). There are several cases on record of syringomyelia (Borchardt,[21] Oppenheim, Marburg[22]), one of multiple sclerosis (Levi), and one of cervicobulbar palsy (Spiller-Gittings[23]), in individuals having cervical ribs. One of Murphy's[24] patients had suffered for thirteen years from an enlargement of the thyroid gland. In cases of this kind it is permissible to assume the presence of some defect of the central nervous system from the embryonic period, the cervical rib representing merely another congenital anomaly. Precisely as in syringomyelia, other changes have been repeatedly met with which had to be interpreted as congenital anomalies of development. Cervical ribs may be associated with a symptom complex which cannot be referred to compression of the plexus, but must be interpreted as manifestations of an hysterical or hysteroneurasthenic type. Oppenheim believes that when this combination is more carefully sought for, numerous cases of cervical rib will probably be found in which the nervous symptoms, even when localized in the arm of the same side, cannot be referred to compression. Syringomyelia in these cases is not uncommonly introduced by a scoliosis, which causes the cervical rib to protrude, giving rise to traction upon the brachial plexus, with the concomitant symptoms.

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[19] Neurol. Centralbl., November 1, 1894.

[20] Symptoms Produced by Seventh Cervical Ribs, Lancet, June 22, 1907, i.

[21] Symptomatologie u. Therapie d. Halsrippen, Berl. klin. Woch., 1901, p. 1265.

[22] Syringomyelie und Halsrippe, Wien. klin. Rundschau, 1906, xiii.

[23] New York Med. Jour., October 5, 1908.

[24] The Clinical Significance of Cervical Ribs, Surg., Gyn., and Obs., October, 1906.

SEQUELS OF CERVICAL RIB IN THE SKELETON. Scoliosis has been frequently reported in association with cervical ribs, the convexity being, as a rule, toward the side of the extra rib, or toward the larger rib in bilateral cases. Four cases of cervical rib, observed by Garré,[25] all presented primary scoliosis in an unusual location, namely, at the transition of the cervical rib into the thoracic spinal column (see my case). Drehmann,[26] who made a special study of this type of scoliosis, arrived at the conclusion that the majority of his cases (10) of primary cervicodorsal scoliosis, limited to a few vertebræ, were due to supernumerary ribs. The motor paresis and gradual muscular atrophy observed in the scoliosis of cervical rib are ascribed by Hoffa to the constant pressure upon the brachial plexus. In view of the small number of clinical cases of cervical rib hitherto published, the relatively high percentage of coincident scoliosis is certainly noteworthy; but while there is an etiological connection between a special form of scoliosis and cervical rib, this does not imply that every cervical rib is necessarily followed by scoliosis. Hochenegg[27] calls attention to the fact that congenital scoliotic curvatures of the cervical vertebral column are very common additional findings in cases of cervical rib.

TREATMENT. In the various desultory writings upon the subject of supernumerary rib there is no approach to unanimity of opinion as to treatment. It is only too generally conceded that conservative measures are indicated when no symptoms are present or only those of moderate pressure on the plexus. Removal of the rib, according to some observers, remains as an emergency procedure when palliative measures have failed. It is true that cervical rib is frequently associated with central nervous disease, to which the symptoms may be largely referable. A recent writer on the subject, Hinds Howell, maintains that palliative measures be tried even in severe cases. In the case reported by Kammerer the atrophic muscles of the left arm were in the same condition three and one-half months after the pressure on the plexus had been removed. Howell reports two cases and Furnrohra[28] a third, in which operation was followed by complete paralysis of the arm. The plexus not having been ostensibly damaged, it is claimed that the nerves reacted thus to surgical traumatism. It is possible that the report of these cases was given too soon after operation. One year at least should elapse before one may judge of what degree of repair to expect. Removal of the rib in Marbourg's case was followed by rapid progress of the trophic and sensory disturbances, with progressive symptoms of syringomyelia. This writer is opposed to operation in complicated cases. One of Israel's patients was operated upon for a severe brachial neuralgia without motor disturbance. The operation had no effect whatsoever upon the neuralgia, and a serratus paralysis was added when the patient was seen a few months after. Beck[29] is likewise of the opinion that the removal of a cervical rib which causes no disturbance is unwarranted. Rawling[30] says, on the basis of two cases operated upon by him and two others operated on in St. Bartholomew's Hospital, that complete removal is usually a matter of the greatest difficulty, due to the small area of operative field and the numerous muscular attachments which the rib receives. In removing these, many small but troublesome vessels are divided. Complete removal, with ablation of the projecting part of the bone only, may be followed by a temporary relief of the symptoms, which return, however, as the result of new bone formation at the free extremity of the resected rib. My own observation does not substantiate this statement. In Beck's case the symptoms returned with undiminished vehemence three months later, and another operation became necessary. Jones mentions two instances illustrating a return of pain and muscular weakness and due to new bone formation. It is therefore imperative that the removal be complete, that is, that the periosteum be removed together with the rib.

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[25] Ztschr. f. orthop. Chir., 1903, ii.

[26] Allgem. med. Ctrztg., 1906, No. 2.

[27] Lehrb. d. spez. Chirurgie, 1907.

It is doubtless true that the removal of a cervical rib requires an experienced and dexterous operator. The very marked advance, however, in modern surgical technique, especially in what might be called neurological surgery, leads us to a greater degree of boldness in handling surgically those cases of cervical rib in which serious disturbances on the part of the nervous or vascular system manifest themselves. The achievements of later-day surgery in resection of nerves, especially parts of the brachial plexus, warrant a more radical procedure and assurance of better results than have hitherto attended operations. In view of the rapidity with which compression symptoms of cervical rib sometimes develop, it may be questioned whether the removal of these ribs be advised when their presence becomes clinically demonstrable.

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[28] Quoted by Hinds Howell.

[29] Jour. Amer. Med. Assoc., June 17, 1905.

[30] Ibid.

The salient points in the case which I have presented might be summed up as follows: (1) Onset of symptoms at an unusually early age (seven years). (2) Severity of symptoms, which were practically limited to the nervous system. (3) Hypesthesia in the region supplied by the inner cord of the brachial plexus (ulnar distribution). (4) Progressive atrophy of the small muscles of the hand, including the thenar and hypothenar eminences. (5) Cervicodorsal scoliosis. (6) Stationary character of the symptoms referable to the cervical rib, in the absence of surgical intervention. (7) Demonstration of the exact location of the roots of the brachial plexus in their relation to the supernumerary rib on the left side; digital pressure upon each producing numbness and tingling in corresponding area of arm. (8) Diminution in size of the third normal rib on the left side, well shown in the radiogram. (9) Beginning symptoms due to pressure on the opposite side. (10) Surgical removal of both cervical ribs.

THE INTERPRETATION OF APHASIA.

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General Considerations. The novel and revolutionary views of Pierre Marie, the vigorous defence of the classic theories by Dejerine, the noteworthy revisions of the subject by Moutier and by von Monakow, and the brilliant discussion before the Neurological Society of Paris have aroused a keen interest in aphasia, and have given an especial zest to its study. Like others, I have studied anew the material at my disposal, and have endeavored to lay aside, for the time being, previously acquired impressions and beliefs. The interpretation of aphasia is most important, as this affects vitally our conceptions of cerebral function in its entirety. That which follows presents in brief the point of view at which I have arrived. The cases used in illustration are, of course, cited merely in outline.

Whatever view we may be disposed to take with regard to the nature of aphasia, whether we accept the older or classic view, that aphasia consists of two primarily and essentially different elements, sensory and motor, or whether we hold with Marie that aphasia is a unity the essential characteristic of which is an impairment of the faculty of speech comprehension, it will best serve the purposes of

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[1] Read at the International Medical Congress, Buda-Pest, September 1, 1909.